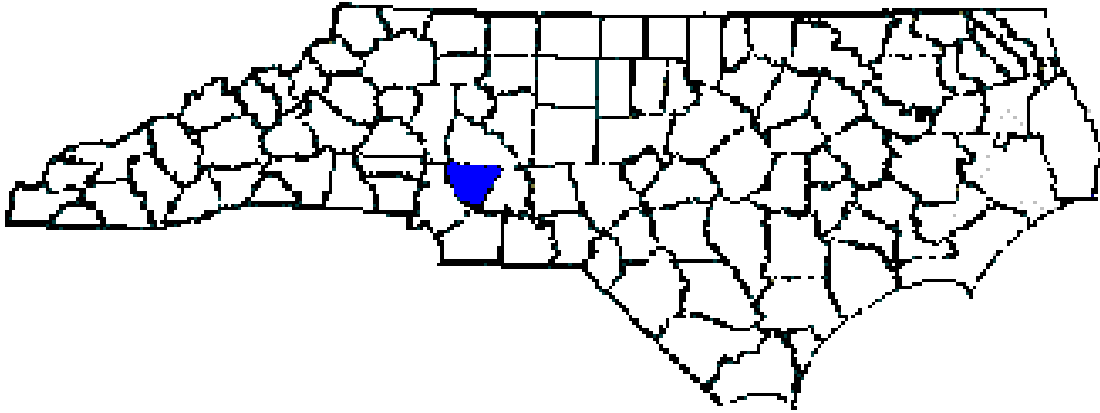
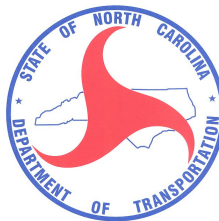


# ANNUAL REPORT FOR 2010



**UT to Cold Water Creek Mitigation Site  
Cabarrus County  
TIP No. R-2533B (Site 23)**



Prepared By:  
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North Carolina Department of Transportation  
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## **SUMMARY**

The following report summarizes the stream monitoring activities that have occurred during the Year 2010 at the UT to Cold Water Creek Stream Mitigation Site (permitted Site #23) in Cabarrus County. The North Carolina Department of Transportation (NCDOT) completed construction in March 2005. This report provides the monitoring results for the fourth formal year of monitoring (Year 2010). The Year 2010 monitoring period was the fourth of five scheduled years of monitoring on the UT to Cold Water Creek Mitigation Site (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring at permitted Site #23 for UT to Cold Water Creek, it has met the required monitoring protocols for the fourth formal year of monitoring. The channel throughout the relocated stream is stable at this time. The stream bank and buffer area were heavily vegetated. The North Carolina Department of Transportation will continue stream monitoring at the UT to Cold Water Creek Mitigation Site for 2011.

## **1.0 INTRODUCTION**

### **1.1 Project Description**

The following report summarizes the stream monitoring activities that have occurred during the Year 2010 at the UT to Cold Water Creek Stream Mitigation Site. Site # 23 is located on NC 49 in Cabarrus County at Sta. 164+00 to Sta. 166+00 –L1- RT. (Figure 1). The UT to Cold Water Creek Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2533B in Cabarrus County.

The mitigation site provided approximately 718 linear feet of stream restoration. Construction was completed during March 2005 by the North Carolina Department of Transportation (NCDOT). Stream restoration involved restoring sinuosity to the stream, sloping the adjacent streambanks to promote stability, and widening the floodplain to allow for major flood events. It also included the installation of cross vanes, coir fiber matting and live stakes along the streambank, and bareroot seedlings in the buffer area.

### **1.2 Purpose**

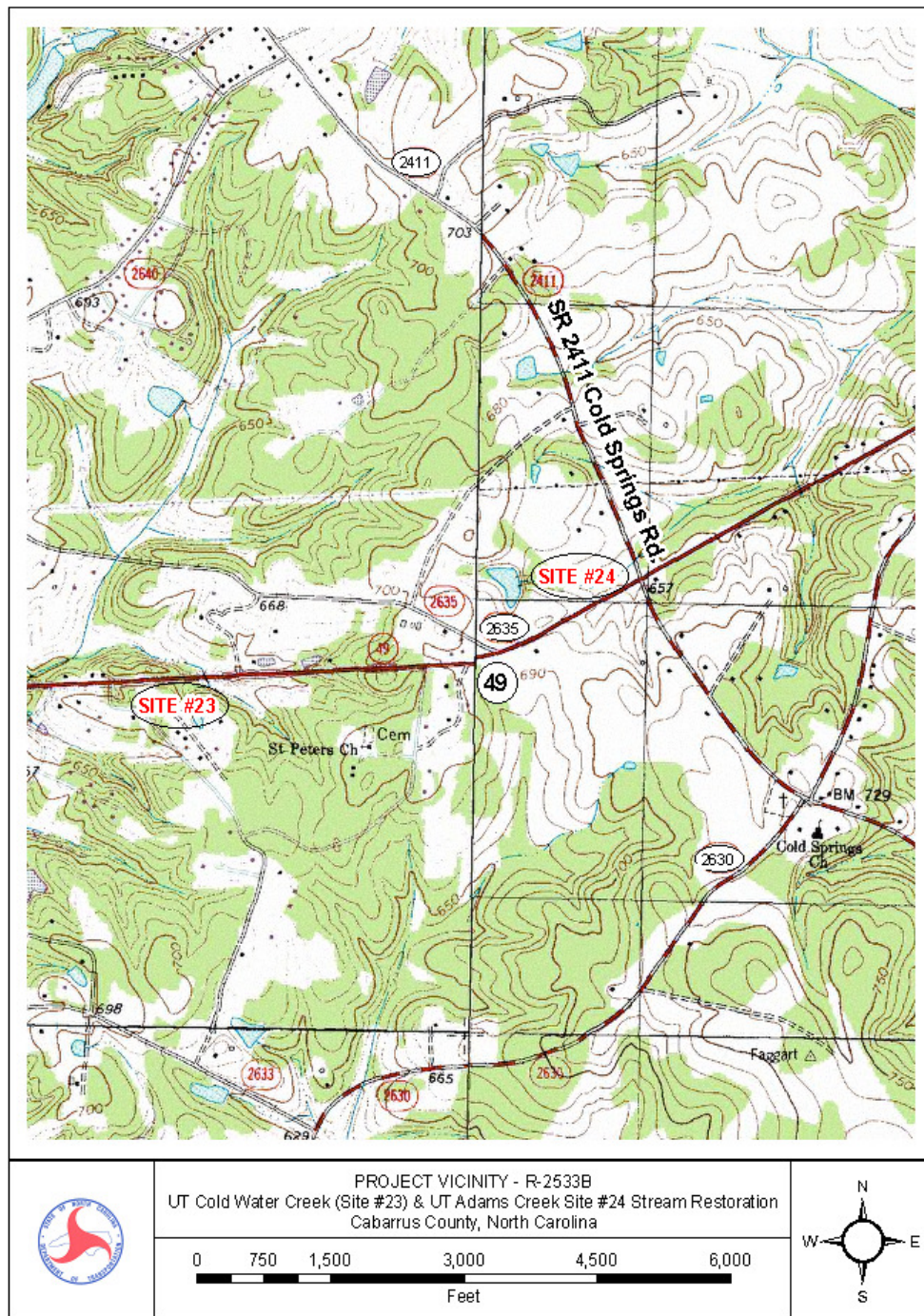
In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2010 at the UT to Cold Water Creek Mitigation Site. Hydrologic monitoring was not required for this site.

### **1.3 Project History**

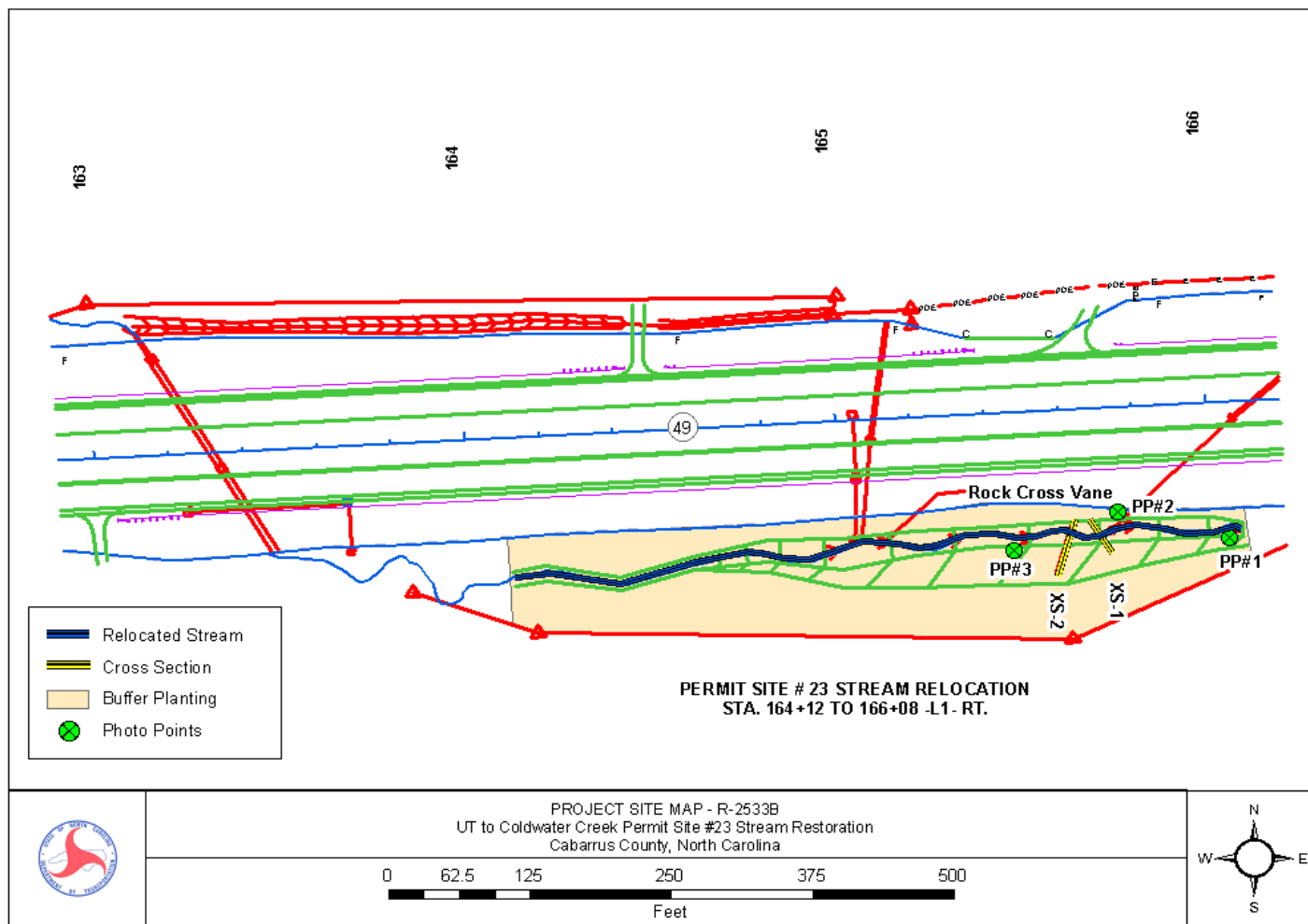
March 2005	Construction Completed.
March 2007	Stream Channel Monitoring (1 year)
March 2008	Replanted Site
September 2008	Stream Channel Monitoring (2 year)
October 2009	Stream Channel Monitoring (3 year)
October 2010	Stream Channel Monitoring (4 year)

### **1.4 Debit Ledger**

The entire UT to Cold Water Creek (Site #23) stream mitigation site was used for the R-2533B project to compensate for unavoidable stream impacts.



**Figure 1. Site Location Map**



**Figure 2. Site #23 Map**

## **2.0 STREAM ASSESSMENT**

### **2.1 Success Criteria**

The following surveys were conducted in support of the monitoring assessment and in accordance with the regulatory permits obtained for this project:

#### **Stream Geomorphological Assessment**

- ◆ The stream shall be monitored for a duration of five years from the end of construction (channel modifications and vegetation planted)
- ◆ The data shall be collected and submitted to the US Army Corps of Engineers and N.C. Division of Water Quality no later than January 1<sup>st</sup> each year for five years after construction
- ◆ At Site #23, 718 linear feet of stream channel will be relocated. A permanent cross section shall be established in a meander and at an inflection point along the channel.
- ◆ In order to evaluate the stability of the new channel, the channel cross section at each permanent station identified above shall be measured on a yearly basis for five years and width:depth ratio compared to the as-built cross section

### **2.2 Stream Description**

#### ***2.2.1 Post-Construction Conditions***

The restoration of UT to Cold Water Creek Site #23 involved restoring sinuosity to the streams, sloping the adjacent streambanks to promote stability, and widening the floodplain to allow for major flood events. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area throughout the entire reach.

#### ***2.2.2 Monitoring Conditions***

The objective of the UT to Cold Water Creek Site #23 stream restoration was to build an E4/E5 to E4b/E5b stream as identified in Rosgen's Applied River Morphology. A total of two cross sections (one in a riffle and one in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented below in Table 1 (Site #23).

**Table 1. Abbreviated Morphological Summary (UT Cold Water Creek Site #23)**

Variable	Proposed	2007	2008	2009	2010	2011
		Riffle Cross-Section #1	Riffle Cross-Section #1	Riffle Cross-Section #1	Riffle Cross-Section #1	
Drainage Area (mi <sup>2</sup> )	0.1	0.1	0.1	0.1	0.1	
Bankfull Width (ft)	6.0	5.7	6.0	6.02	5.82	
Bankfull Mean Depth (ft)	2.0	0.8	0.8	0.64	0.57	
Width/Depth Ratio	3	7.0	7.4	9.41	10.21	
Bankfull Cross Sectional Area (ft <sup>2</sup> )	12.0	4.6	4.8	3.88	3.33	
Maximum Bankfull Depth (ft)	3.0	1.2	1.3	1.04	1.03	
Width of Floodprone Area (ft)	18-100	9.0	10.1	8.78	8.68	
Entrenchment Ratio	3.0-16.7	1.6	1.7	1.46	1.49	

\* Riffle values are used for classification purposes, pool values are shown in Appendix A.

## 2.3 Results of the Stream Assessment

### 2.3.1 Site Data

The assessment included the survey of two cross sections at Site #23. Longitudinal profile monitoring was not required per the permit conditions and therefore was not completed. All of the cross sections were established during the 2007 monitoring year. Cross section locations were determined based on choosing segments that were representative of the entire reach. The cross sections are shown in Appendix A.

Site #23 Cross-Sections:

- ◆ Cross-Section #1: UT Cold Water Creek Site #23, midpoint of riffle
- ◆ Cross-Section #2: UT Cold Water Creek Site #23, midpoint of pool

Based on comparisons of all the years of monitoring data, all of the cross sections appear stable with little or no active bank erosion. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment; however, this information should remain similar in appearance. Pebble counts were not required per the permit conditions and therefore were not completed.



### **3.0 VEGETATION: UT to COLD WATER CREEK**

#### **3.1 Description of Species**

The following tree species were planted on the stream bank:

*Salix nigra*, Black Willow

*Cornus amomum*, Silky Dogwood

*Alnus serrulata*, Tag Alder

The following tree species were planted in the buffer area:

*Liriodendron tulipifera*, Yellow Poplar

*Platanus occidentalis*, Sycamore

*Quercus nigra*, Water Oak

*Faxinus pennsylvanica*, Green Ash

#### **3.2 Results of Vegetation Monitoring**

**Streambank & Buffer Vegetation:** The stream was vegetated partially with black willow, silky dogwood, cattails, tulip poplar, pokeberry, briars, sycamore, green ash, water oak, and various herbaceous species. Lespedeza was very dense along portions of the site. In accordance with the permit conditions, only visual monitoring of the stream and buffer vegetation is required, therefore no vegetation plots were set at this site.

#### **3.3 Conclusions**

There were no vegetation monitoring plots established throughout the buffer planting area. After the fourth year of monitoring, the UT Cold Water Creek mitigation site shows by visual observation that the tree species planted in the streambank and buffer areas are surviving. NCDOT recommends continuing the visual vegetation monitoring of this site.

### **4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS**

The UT to Cold Water Creek mitigation site has met the required monitoring protocols for the fourth formal year of monitoring. The channel throughout the relocated stream is stable at this time. The streambank and buffer have planted vegetation surviving for the fourth formal year of monitoring. NCDOT will continue monitoring the UT to Cold Water Creek Mitigation Site in 2011.

## **5.0 REFERENCES**

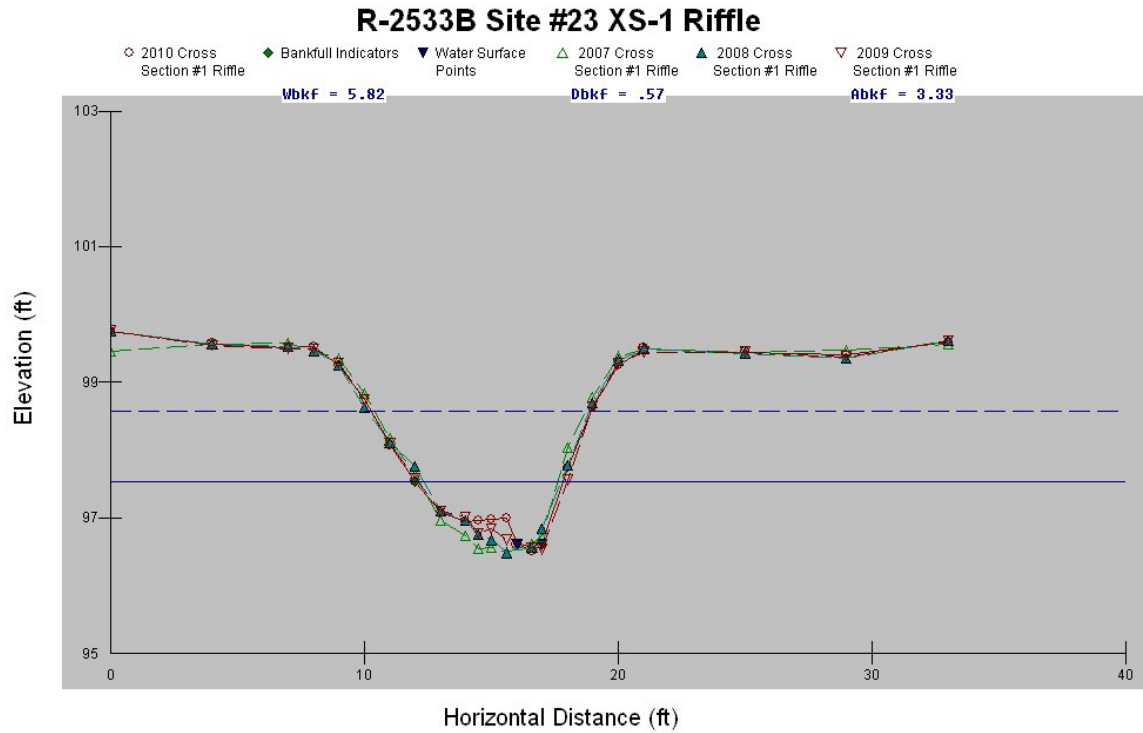
North Carolina Department of Transportation (NCDOT), November 19, 2001.  
Permit for R-2533A and R-2533B (Action ID.199702364).

North Carolina Department of Transportation (NCDOT), November 26, 2001.  
Permit for R-2533A and R-2533B (DWQ Project No. 011274).

Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

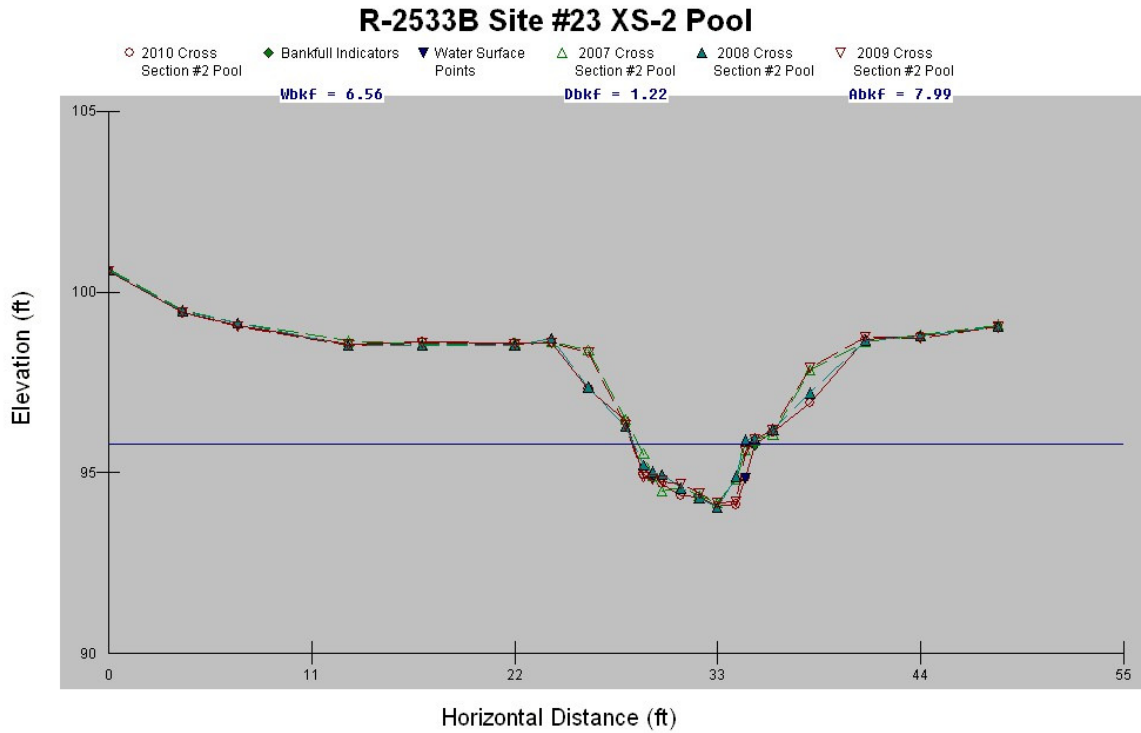
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines.  
Prepared with cooperation from the US Environmental Protection Agency,  
NC Wildlife Resources Commission, and the NC Division of Water Quality.

**APPENDIX A**  
**CROSS SECTIONS**



**Site #23: Cross-Section #1 (Riffle) Abbreviated Morphological Summary**

	2007	2008	2009	2010	2011
<b>Bankfull Cross Sectional Area (ft<sup>2</sup>)</b>	4.6	4.8	3.88	3.33	
<b>Maximum Bankfull Depth (ft)</b>	1.2	1.3	1.04	1.03	
<b>Width of the Floodprone Area (ft)</b>	9.0	10.2	8.78	8.68	
<b>Bankfull Mean Depth (ft)</b>	0.8	0.8	0.64	0.57	
<b>Width/Depth Ratio</b>	7.0	7.4	9.41	10.21	
<b>Entrenchment Ratio</b>	1.6	1.7	1.46	1.49	
<b>Bankfull Width (ft)</b>	5.7	6.0	6.02	5.82	



**Site #23: Cross-Section #2 (Pool) Abbreviated Morphological Summary\***

	2007	2008	2009	2010	2011
<b>Bankfull Cross Sectional Area (ft<sup>2</sup>)</b>	7.83	7.1	5.86	7.99	
<b>Maximum Bankfull Depth (ft)</b>	1.39	1.9	1.41	1.71	
<b>Bankfull Mean Depth (ft)</b>	0.86	1.2	0.98	1.22	
<b>Bankfull Width (ft)</b>	9.13	6.2	5.99	6.56	

\* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

**APPENDIX B**  
**SITE PHOTOGRAPHS**



# UT Cold Water Creek Site #23



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)  
October 2010



Photo Point #3 (Downstream)